coupling the chuck to the pedestal;

coupling the wafer to the coupled chuck;

rotating the pedestal so as to rotate the coupled chuck and the coupled wafer; and

plasma etching the rotating wafer while cooling the chuck.

REMARKS

Reconsideration and allowance of this application, as amended, are respectfully requested. Claims 10 and 26 have been amended; claims 10, 12-16, and 26 remain pending in the application. The objection and rejections are respectfully submitted to be obviated in view of the amendments and remarks presented herein.

In Applicants' First Preliminary Amendment filed July 16, 2002, claims 10 and 26 were amended to define the coolant that cools the chuck as being a "gaseous coolant." In the present Amendment, claims 10 and 26 have been further amended to even more specifically define i) the location of the hollow shaft through which the gaseous coolant flows, and ii) the flow path of the gaseous coolant. For example, claim 10 has been amended to recite a "pedestal comprising a central bore having a *central* hollow shaft disposed therein," and that "the hollow shaft [is] capable of the *one-way* communication of a gaseous coolant *to* the coolant chamber."

Support for the recitation of a *central* hollow shaft is found, for example, in the depiction the hollow lift rod 102b in Applicants' drawing Figs. 1 and 3. The claimed hollow shaft is depicted as being in the center of the central bore 72c. Support for the recitation of the *one-way* communication of a gaseous coolant *to* the coolant chamber is found, for example, in the depiction the hollow lift rod 102b in Applicants' drawing Figs. 1 and 3. That is, as depicted in Fig. 3, for example, the sole path for the flow of the gaseous coolant is from a source to rotational coupler 114 to vented screw 116 to hollow lift rod 102b to coolant chamber 100. Thus, the gaseous coolant flows through the hollow shaft to the coolant chamber, but, after having served its cooling function, the gaseous coolant does not flow back out through the hollow shaft. Support for the recitation is also found in the description of the gaseous coolant and hollow lift rod 102b at specification page 10 line 23, through page 11, line 4 (i.e., "the lift rod 102b conveys helium to the coolant chamber 100").

In response to the objection to the drawings, Applicants' representative notes that in Applicants' Amendment filed November 9, 2001, the written description was editorially amended to correct the reference number associated with the hollow lift rod (i.e., corrected to "102b"). See Amendment pages 2, 3, 9, 10, and 4 (at page 4: "In the present Amendment, the written description has been amended to correct a misspelling at page 8 *and to correct the description of the hollow lift rod 102b at pages 10 and 11.*") Reconsideration and withdrawal of the objection are respectfully requested.

35 U.S.C. § 102(b) or 103(a) – Helms

Claims 10, 12-13, 16, and 26 stand rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by, or, in the alternative, under 35 U.S.C. § 103(a) as obvious over, U.S. Patent No. 4,869,801 to Helms et al. (hereinafter "Helms"). The Office Action asserts, *inter alia*, that "[a]n embodiment represented in Fig. 4 of Helms and described in detail in col. 4 lines 13+ anticipates the present invention." The Office Action also asserts that "[t]he wafer is placed on a chuck plate which is coupled to a pedestal with a central hollow shaft" and that "[t]he chuck and pedestal combine to define cooling passages (73, 74, 75 in Fig. 4) connected in fluid communication with the hollow shaft." While conceding that "[i]t is unclear if the cooling medium is limited to only a liquid," the Office Action concludes that "it would have been obvious . . . to use a gas coolant since Helms et al. suggests as much in col. 3, line 1."

The rejection is respectfully traversed. The disclosure of Helms does not anticipate Applicants' claimed invention, as is required to support a § 102(b) rejection.

Helms does not anticipate Applicants' claimed method because it fails to disclose, *inter alia*, the claimed "hollow shaft capable of the *one-way* communication of a *gaseous* coolant *to* the coolant chamber" (emphasis added). The Office Action relies upon the "embodiment represented in Fig. 4 of Helms and described in detail in col. 4 lines 13+." At column 4, lines 21-22, Helms discloses in pertinent part that "[t]he substrate holder 53 consists of the *watercooled* substrate holder 44 . . ." Thus, Helms employs water to cool the substrate holder, not Applicants' claimed gaseous coolant.

The Office Action asserts that "[i]t is unclear if the cooling medium is limited to only a liquid." In view of Helms' disclosure of "the *watercooled* substrate holder 44," however, Applicants respectfully disagree. At column 4, lines 35-39, Helms does disclose that "[h]elium or another suitable gas is blown into the space 57 thus closed during the processing of the substrate 8 so as to increase the thermal conductivity between the substrate 8 and the support plate 44." Helms provides no description whatsoever though of how, and with what structural features, the gas is "blown" into space 57. From the context of the disclosure of the gas, however (i.e., in conjunction with the description of ring gaskets 55 and 56), it is apparent that the gas is not associated with Helms' coolant passages (discussed below).

Just as Helms fails to disclose Applicants' claimed gaseous coolant feature, Helms similarly fails to disclose Applicants' claimed "hollow shaft capable of the *one-way* communication of a gaseous coolant *to* the coolant chamber." Instead, at column 4, lines 60-66, Helms discloses that

> The coolant passages 63, 64, 65, in the interior of the hollow shaft 45 are separated from one another by means of thin-walled tubes 90 and 91, and are connected by annular passages to the pipelines 69, 70 and 71 on the one hand, and on the other hand to the cooling passages 73, 74 and 75.

Reference to Helms' Fig. 4 reveals that pipelines 70 and 71 are coolant *inlet* lines, and that pipeline 69 is a coolant *outlet* line (by virtue of the directional arrows). Since the "coolant passages 63, 64, 65, in the interior of the hollow shaft 45 . . . are connected by

annular passages to the pipelines 69, 70 and 71," the coolant must flow into the hollow shaft through pipelines 70 and 71, and out of the hollow shaft through pipeline 69. In Applicants' claimed method, however, the gaseous coolant flows only one way through the hollow shaft – to the coolant chamber. Thus, Helms does not anticipate Applicants' claimed invention.

Similarly, the claimed invention would not have been obvious because there is no suggestion or motivation, either in Helms or in the knowledge generally available to one of ordinary skill in the art, to modify the reference teachings to attain the claimed invention.

The Office Action asserts that "it would have been obvious . . . to use a gas coolant since Helms et al. suggests as much in col. 3, line 1." At column 2, line 64, through column 3, line 4, Helms discloses the following with regard to Figs. 2 and 3:

> The substrate support 14 is cooled with a liquid flowing through two cooling water passages of which only one is represented. The coolant is fed in and out through two bores in the wall of the hollow shaft 13. A third passage 15" in the hollow shaft 13 carries a coolant gas, helium for example, which emerges underneath the substrate in the middle of the substrate support 14 and cools it by the conduction of heat to the substrate support 14.

The apparatus depicted in Helms' Figs. 2 and 3, however, is different from that depicted in Helms' Fig. 4 (discussed above in response to the rejection under § 102(b)). In the apparatus depicted in Figs. 2 and 3, the coolants do not flow through a *central* hollow shaft of a central bore, as claimed. They flow instead around the perimeter of the hollow shaft 13.

Furthermore, there is no suggestion in Helms to use the gas coolant associated with the apparatus depicted in Figs. 2 and 3, in the Fig. 4 watercooled apparatus. In fact, in the description associated with the Figs. 2 and 3 apparatus, Helms describes the "*delivery and return* of the cooling water" (column 3, lines 42-43), but only the "*introduction* of the cooling gas" (column 3, lines 44-45). There is, therefore, no cooling gas *return* line associated with the apparatus depicted in Helms Figs. 2 and 3. The Office Action's combination of Helms' cooling gas disclosed at "col. 3, line 1" associated with the apparatus of Figs. 2 and 3 (which has no cooling gas return line) with the watercooled apparatus of Helms' Fig. 4 (which uses water delivery and return lines) is therefore illogical, and most certainly would not result in Applicants' claimed method.

Finally, for the reasons discussed below, Helms' specification and drawings are inconsistent with one another, and it is respectfully submitted that the Office Action's reliance upon Helms is suspect. For example, as indicated above, at column 2, line 64, through column 3, line 4, Helms discloses the following with regard to Figs. 2 and 3:

> The substrate support 14 is cooled with a liquid flowing through two cooling water passages of which only one is represented. The coolant is fed in and out through two bores in the wall of the hollow shaft 13. A *third passage 15"* in the hollow shaft 13 *carries a coolant gas*, helium for example, *which emerges underneath the substrate in the middle of the substrate support 14* and cools it by the conduction of heat to the substrate support 14 (emphasis added).

But, at column 3, lines 42-47, Helms discloses that

> The delivery and return of the cooling water through the lines 15 and 15' and water inlet 68 and water outlet 67 and the *introduction of the cooling gas through the gas inlet 66* into the hollow shaft 13 are performed through a rotary connection 25 (emphasis added).

Inspection of Figs. 2 and 3 reveals that Helms' disclosure of carrying coolant gas in "third passage 15"" is inconsistent with the disclosure of "introduction of the cooling gas through the gas inlet 66." In Fig. 2, gas inlet line 66 becomes cooling water delivery line 15 (on the right-hand side of Fig. 2, see reference number 15 just above cover 86 of the housing of substrate table 4). And, Helms' description of the coolant gas third passage 15" emerging "underneath the substrate *in the middle* of the substrate support 14" is also completely inaccurate. As is evident from Fig. 2, third passage 15" emerges not at the *middle* of the substrate support 14, but rather, at the perimeter of hollow shaft 13. Inspection of Helms' Fig. 3 top view confirms that gas coolant third passage 15" (see left-hand side of Fig. 3) emerges at least half way between axis 79 and the outside of the substrate holder, not at the *middle* of the substrate support.

Therefore, the claimed invention would not have been obvious because there is no suggestion or motivation, either in Helms or in the knowledge generally available to one of ordinary skill in the art, to modify the reference teachings to attain the claimed invention.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 10, 12-13, 16, and 26 under §§ 102(b) and 103(a) are respectfully requested.

35 U.S.C. § 103(a) – Helms further in view of Saeki and Nozawa

Claims 14 and 15 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Helms, and further in view of U.S. Patent No. 5,460,684 to Saeki et al. (Saeki) and U.S. Patent No. 5,290,381 to Nozawa et al. (Nozawa).

For all of the reasons indicated above with respect to the rejections over Helms under §§ 102(b) and 103(a), the rejection is respectfully traversed. The claimed invention would not have been obvious because there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention. Claims 14 and 15 depend from claim 10. Regardless of what Saeki and Nozawa may teach with regard to the use of an electrostatic chuck and the optimization of process parameters, the asserted combination is deficient for all of the reasons articulated above with respect to the rejections over Helms under §§ 102(b) and 103(a).

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 14 and 15 under § 103(a) are respectfully requested.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully

requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

Dated: November 13, 2002

Respectfully submitted,

By _____

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Version With Markings to Show Changes Made

In the Claims

Please amend the claims as follows:

10. (Four times amended) A method of plasma etching a wafer, said method comprising:

coupling a chuck to a rotatable pedestal, the pedestal comprising a central bore having a central hollow shaft disposed therein, the chuck and the pedestal cooperating to define a coolant chamber in fluid communication with the hollow shaft, the hollow shaft capable of the one-way communication of a gaseous coolant to the coolant chamber;

coupling the wafer to the chuck;

rotating the pedestal so as to rotate the coupled wafer; and

plasma etching the rotating wafer while cooling the chuck by communicating [a] the gaseous coolant through the hollow shaft to the coolant chamber.

26. (Twice amended) A method of plasma etching a wafer by means of a plasma etching machine comprising a process chamber, a rotatable, internally cooled chuck disposed in the process chamber, a clamp coupled to the chuck; a controller coupled to the process chamber and chuck for controlling gas flow and pressure in the process chamber and rotation

of the chuck, a pedestal coupled to the chuck and cooperating therewith to define a coolant chamber, the pedestal including a central coolant passage in fluid communication with a gaseous coolant source and the coolant chamber, the coolant passage capable of the one-way communication of a gaseous coolant to the coolant chamber; and a lift actuator coupled to the coolant passage, the coolant passage moving in the pedestal in response to actuation of the lift mechanism to lift the wafer from the chuck, said method comprising the steps of:

coupling the chuck to the pedestal;

coupling the wafer to the coupled chuck;

rotating the pedestal so as to rotate the coupled chuck and the coupled wafer; and

plasma etching the rotating wafer while cooling the chuck.